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| EXAMINER | |
|---|---|
| WALKER, KEITH D | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1795 | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/845,985 | CHALONER-GILL ET AL. | |
| | **Examiner** | **Art Unit** | |
| | KEITH WALKER | 1795 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *22 April 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-3,6-9,12,14-21,48-50,52-56 and 58-61* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6-9,12,14-21,48-50,52-56 and 58-61* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

Claims 1-3, 6-9, 12, 14-21, 48-50, 52-56 & 58-61 are pending examination as discussed below.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-3, 6, 7, 12, 14-17, 19-21, 48-50, 52, 53, 55, 56 and 58-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,538,814 (Kamauchi) in view of US 5,789,115 (Manev).

The instant claims are to a collection of particles comprising a crystalline composition with a phosphate anion and a lithium cation; the collection of particles has an average particles size of less than about 1000 nm and i) having essentially no particle with a diameter greater than about 5 times the average particle size (independent claims 1 and 21,) OR ii) having a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter (independent claims 55 and 58).

Kamauchi teaches a lithium secondary battery with a lithium cobalt phosphate active material with an average particle size of 10 nm to 20 $\mu$m (claims 1-14, claim 3.)

Examples 10 and 12 and Table 7 teach active material sizes on the order of 500 and 10 nm. The reference teaches ball-milling the materials to give small particles sizes. Other metals may be added to the lithium cobalt phosphate active material (col. 4, lines 10-65.) Lithium, cobalt and nickel are included in the active material of example 4. The material may be crystalline or amorphous (col. 6, lines 1-20.) The material may be of the formula $LiCoPO_4$ with Fe substituted for the Co (col. 4, lines 15-55.) Various substituents may be substituted into the lithium transition metal oxide complex (col. 1, lines 55-67). The lithium transition metal oxide active material is uniformly blended and formed into a positive electrode. With regard to the phrases “less than about,” “greater than about,” and “at least about” in the claims, the reference is considered to include points both within and “about” the end points of the range based on the teachings of 10 nm to 20 $\mu$m.

The reference does not teach that the collection of particles has essentially no particle with a diameter greater than about 3 times or 5 times the average particle size OR that at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter.

Manev teaches cathode materials for a lithium battery. The mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for lithium secondary batteries. The properties are important because they directly influence the charge-discharge rate capacity, the safety cell performance and other features of the battery. A decrease in the mean particle size and the distribution typically results in an increase in the cycleability of

these electrode active materials (col. 1, lines 34-50.) Smaller particles are relatively more flexible and cycling does not damage the material to the degree of larger particles. Based on the teachings of Kamauchi and Manev, it would be obvious to one of ordinary skill in the art at the time the invention was made to prepare an electrode of a collection of particles for an electrode material of Kamauchi having a greater number of particles as close in size to the desired average diameter as possible, as the average diameter has been shown to be critical to the invention (Kamauchi col. 5, lines 25-end; Manev col. 1, lines 34-50.) Similarly, it would be obvious to have an electrode with at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter. The Kamauchi reference teaches a uniformly blended mixture where no undesirably large, irregular pores are formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode. Having a greater range of active material particle sizes will cause a less uniform blended mixture, which is taught to be undesirable by the reference. One of ordinary skill in the art has the knowledge, based on Kamauchi and Manev, to prepare or select particles of preferred sizes by pulverizing or filtering the materials. Further, one of ordinary skill in the art would be motivated to choose specific particles of the average diameter for the electrode, as particles of this diameter are taught to increase the capacity of the electrode (col. 5, lines 30-35.) Pulverizing the particles will provide particles in the nanometer scale range (col. 5, lines 30-36.) It is noted that MPEP 2144.05(b) notes that optimization of ranges within prior art conditions or through

routing experimentation is not inventive. The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

2. Claims 8, 9 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,910,382 (Goodenough), in view of US 5,538,814 (Kamauchi), and US 5,789,115 (Manev), as applied in the previous section.

Goodenough teaches cathode materials for a lithium secondary battery including $LiFePO_4$ and $LiFe_{1-x}Mn_xPO_4$, where x is between 0 and 1. The anode is lithium metal or a lithium intercalation material (col. 1.) The reference is silent to the size of the active material particles. Thus, the reference does not teach that the collection of particles has essentially no particle with a diameter greater than about 3 times or 5 times the average particle size OR that at least 95 percent of the particles have a diameter greater than about 40 percent and less than about 160 percent of the average diameter.

Kamauchi teaches a lithium secondary battery with lithium transition metal oxide complexes, including a lithium cobalt phosphate cathode active material with an average particle size of 10 nm to 20 $\mu$m (col. 5, line 25 to col. 6, line 20 and claims 1-14.) Other metals may be added to the active material including iron and manganese (col. 1, lines 55-end and col. 4, lines 10-65.) The electrode material is pulverized into particles having an average size of 10 nm to 20 $\mu$m. Manev teaches cathode materials for a lithium battery. Manev teaches that the mean particle size and the particle size distribution are two of the basic properties characterizing the positive electrode intercalation materials for lithium secondary batteries. The properties are important

because they directly influence the charge-discharge rate capacity, the safety cell performance and other features of the battery. A decrease in the mean particle size and the distribution typically results in an increase in the cycleability of these electrode active materials (col. 1, lines 34-50.) Smaller particles are relatively more flexible and cycling does not damage the material to the degree of larger particles. The figures show various particle distributions. It would be obvious to one of ordinary skill in the art at the time the invention was made to prepare the cathode materials of Goodenough with a size of less than 1000 nm, as small sizes provide an increased surface area and uniform dispersion through the electrode, which increases the capacity of the positive electrode as shown by Kamauchi.

Based on the teachings of Kamauchi and Manev, it would be obvious to one of ordinary skill in the art at the time the invention was made to prepare an electrode of a collection of particles for an electrode material of Kamauchi having a greater number of particles as close in size to the desired average diameter as possible, as the average diameter has been shown to be critical to the invention (Kamauchi col. 5, lines 25-end; Manev col. 1, lines 34-50.) The Kamauchi reference teaches a uniformly blended mixture where no undesirably large, irregular pores are formed in the electrode. These irregular pores cause cracks and defects that decrease the capacity of the electrode. The reference further teaches that increasing the time of ball milling reduces the size of the active material (examples 10-12.) Having a greater range of active material particle sizes will cause a less uniform blended mixture, which is taught to be undesirable by the reference. One of ordinary skill in the art has the knowledge, based on Kamauchi and

Manev, to prepare or select particles of preferred sizes without grinding or by pulverizing or filtering the materials. Further, one of ordinary skill in the art would be motivated to choose specific particles of the average diameter for the electrode, as particles of this diameter are taught to increase the capacity of the electrode (Kamauchi, col. 5, lines 30-35.) Pulverizing the particles will provide particles in the nanometer scale range (Kamauchi, col. 5, lines 30-36.) It is noted that MPEP 2144.05(b) notes that optimization of ranges within prior art conditions or through routing experimentation is not inventive. The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

3. Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,538,814 (Kamauchi) in view of US 5,789,115 (Manev) as applied to claim 21 and further in view of US 5,232,794 (Krumpelt).

The teachings of Kamauchi and Manev as discussed above are incorporated herein.

Kamauchi and Manev are silent to using $AlPO_4$ for the phosphate composition.

Krumpelt teaches using $AlPO_4$ for the conduction of lithium in batteries (7:25-30). Combining prior art elements according to known methods to yield predictable results and using known techniques to improve similar devices in the same way are considered obvious to one of ordinary skill in the art (KSR, MPEP 2141 (III)).

Therefore it would have been obvious to one of ordinary skill in the art at the time the claimed invention was made to modify the phosphate particles of Kamauchi with the

aluminum phosphate particles of Krumpelt to improve the conductive properties of the battery through the molecular framework created.

***Response to Arguments***

Applicant's arguments filed 4/22/10 have been fully considered but they are not persuasive.

Applicant notes the claims are rejected under the teachings of Kamauchi in view of Manev, which is significantly the same as the Final rejection filed 12/13/06. This statement is correct since it was this same Final rejection dated 12/13/06 that was affirmed by the BPAI on 12/22/08.

Applicant argues the Examiner's questioning of the Declaration and finding of the Declaration as unconvincing not well founded and without support. First, questioning of the Declaration is appropriate when an understanding of the results is required. Second, as discussed the Non-Final action of 1/22/10, the Declaration illustrates that the claimed collection of particles can be made by the methods of Kamauchi and does not answer or overcome any of the issue presented by BPAI in the decision dated 12/22/08. First, applicant has not provided any evidence or explanation that the recited particle size distribution ranges are critical to the invention or that they provide unexpected results. Second, a reasonable expectation for success in achieving the claimed particle sizes is illustrated by the Declaration. For instance, Table 5 shows that for a single sample, 99% of the sample has a particle size smaller than about 1000 nm and a 99.27% is less than 5 times the average particle diameter of 225 nm. This

illustrates that for a single run of a single compound, an average particle size less than the claimed 1000 nm can be achieved with an extremely high percentage before any other treatments. It is noted this average particle diameter is 22.5 times the average particle size of 10 nm taught by Kamauchi. So based on the combined teachings of Kamauchi in view of Manev, it would be obvious to not use the 0.73% of particles that are larger than 5 times the average since Manev teaches limiting the distribution to less than 5 times the mean particle diameter. Also, it is noted that on page 6 of the Declaration, applicant shows in Table B that 0.73% of the particles are greater than the 5 times greater than mean size. However, in Table A, the number closest to the 5 times mean size is 1.265 μm and the respective residual percent is 0.53%, not 0.73%.

Applicant argues "The uniformity feature is very important characteristic of the claimed materials." As discussed in the examination history and upheld by the BPAI decision, this very important feature is taught by the combined teachings of Kamauchi in view of Manev. Kamauchi teaches using small particle sizes for increasing the performance of the battery and Manev teaches keeping the particle size distribution to less than 5 times the average diameter, same as applicant. Furthermore, applicant has not provided any evidence of unexpected results for the claimed invention. The only results provided are commensurate with the expectations of one of ordinary skill in the art would expect in view of the teachings of Kamauchi and Manev.

Applicant does not present any new arguments against the rejection over Goodenough in view of Kamauchi and Manev. As no new arguments are presented, the responses to the previous arguments stand as stated earlier.

Applicant argues Krumpelt relates to the formation of an electrolyte. The claims are drawn to a collection of particles. Krumpelt teaches that phosphate particles are known to be used in $AlPO_4$. The sizes are taught by Kamauchi and Manev.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEITH WALKER whose telephone number is (571)272-3458. The examiner can normally be reached on Mon. - Fri. 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Keith Walker/
Primary Examiner, Art Unit 1795